

SPACE PHYSICS SEMINAR

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Exploring Ancient and Modern Mars with the Curiosity Rover: Early Results from the SAM Investigation at Gale Crater

Thursday, October 31, 2013 725 Commonwealth Ave. Refreshments at 3:30pm in CAS 500 Talk begins at 4:00pm in CAS 502

Abstract:

A prime goal of the Mars Science Laboratory Mission is to explore the habitability of ancient Mars. The Sample Analysis at Mars (SAM) instrument suite of instruments on the Curiosity Rover contributes to this study with (1) a search for organic compounds in ancient rocks and soils, (2) measurements of the composition of inorganic volatiles compounds in the atmosphere or extracted from solid materials, and (3) a determination of the isotopic composition of several of these volatiles. The Yellowknife Bay region near the landing site revealed sedimentary layers and clay minerals and the several months spend in exploration of this site have already realized primary mission goals. A prime exploration target for this rover is still the central mound (Mt. Sharp) in Gale crater that shows a diverse mineralogy form orbital infrared spectroscopy and the Curiosity Rover is now making steady progress toward that target.

Early results from SAM will be discussed. These include: new volume mixing ratios for the 5 major atmospheric constituents showing Ar approximately equal to N₂; a new upper limit for the volume mixing ratio of methane; C and O isotope ratios both showing heavier than terrestrial averages; D/H in water more than 5 times terrestrial; and the 40 Ar/ 36 Ar and 36 Ar/ 38 Ar ratios in good agreement with gases trapped in glasses of EETA79001 Mars meteorite values. Major evolved gases from fines scooped from an eolian drift that are likely characteristic of average martian dust are H₂O, CO₂, O₂, SO₂, H₂S, and HCl. Chlorine containing compounds in this material were tentatively identified as perchlorates. Gases evolved from the first drilled samples revealed the presence of clays and the presence of both oxidized and reduced volatiles.